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(54) TOP AIR-OUTLET DEVICE, AIR CONDITIONER, AND MOTION CONTROL METHOD OF THE TOP AIR-OUTLET DEVICE

(57) Disclosed is a top air-outlet device, including a top cover assembly (100), a top air-outlet assembly (200), a detection mechanism (300), an adjustment mechanism (400) and a controller; the top air-outlet assembly (200) is capable of ascending and descending with respect to the top cover assembly (100), the controller is configured to control an ascending and descending motion of the top air-outlet assembly (200) and the top cover assembly (100); the adjustment mechanism (400) and the detection mechanism (300) are respectively disposed on the top air-outlet assembly (200) and the top cover assembly (100); the adjustment mechanism (400) has expanding-retracting elasticity; in the process of the ascending and descending motion of the top air-outlet assembly (200) with respect to the top cover assembly (100), when the adjustment mechanism (400) touches the detection mechanism (300), the detection mechanism (300) sends a detection signal to the controller, to make the controller control the top air-outlet assembly (200) to continue moving within an elastic expanding-retracting range of the adjustment mechanism (400). The top air-outlet device increases a motion stroke of the top air-outlet assembly within the expanding-retracting range of the adjustment mechanism through the adjustment mechanism, such that the top air-outlet assembly can be completely closed with the top cover assembly. An air conditioner and a motion control method for the top air-outlet device are further provided.

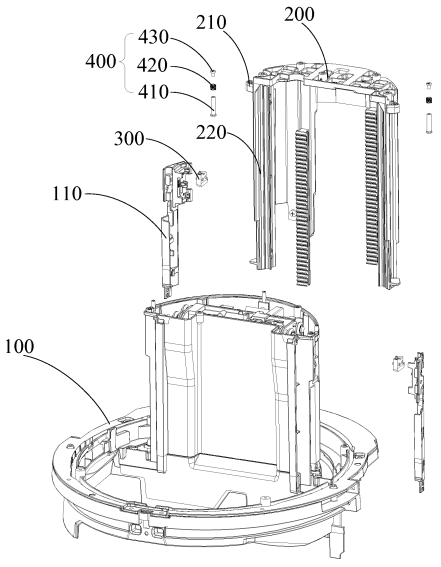

FIG. 1

EP 3 569 946 A1

Description

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority of Chinese Patent Application No. 201710018070.3, filed on January 11, 2017, entitled "Top Air-Outlet Device, Air Conditioner and Motion Control Method for Top Air-Outlet Device", the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a technical field of air conditioning equipment, and more particularly, to a top air-outlet device and an air conditioner having the same, and a motion control method for the top air-outlet device.

BACKGROUND

[0003] At present, some of the cabinet-type air conditioners adopt a top air-outlet mode, that is, an air-outlet panel is disposed at the air conditioner top cover, and the air-outlet is outwardly ventilated. In order to increase the air supply range of the air conditioner and improve the cooling comfort, the air-outlet panel is usually disposed to have an ascending and descending structure with respect to the air conditioner top cover, so that the air-outlet panel can be ascended by a certain distance with respect to the top cover during the working process of the air conditioner, such that the air conditioner can supply airflow to a remote place. When the air conditioner is not working, the air-outlet panel is descended with respect to the top cover, and can be accommodated inside the air conditioner after being in place.

[0004] However, as for the conventional top air-outlet conditioner, the motion stroke of the air-outlet panel is fixed in the process that the air-outlet panel is descended and closed with the air conditioner top cover. When the air outlet panel is descended to a preset position to be closed with the top cover, due to deformation of the air-outlet panel or the top cover structure of the air conditioner, the problem of a gap or uneven closure is likely to occur after closing, which not only affects the appearance of the air conditioner, but also causes external dust to enter the air conditioner and affect the normal operation of the air conditioner.

SUMMARY

[0005] In view of this, to address the technical problem that the conventional air-outlet panel and the top cover are not closed tightly and a gap exists therebetween, it is necessary to provide a tightly closed top air-outlet device, and also provide an air conditioner including the top air-outlet device, and a motion control method for the top air-outlet device.

[0006] The above objective is achieved by the following technical solutions.

[0007] A top air-outlet device is provided, which includes: a top cover assembly, a top air-outlet assembly, a detection mechanism, an adjustment mechanism and a controller;

the top air-outlet assembly is capable of ascending and descending with respect to the top cover assembly, such that an air outlet of the top air-outlet assembly can be opened or closed by the top cover assembly; the controller is configured to control an ascending and descending motion of the top air-outlet assembly with respect to the top cover assembly;

the adjustment mechanism is disposed on one of the top air-outlet assembly and the top cover assembly, the detection mechanism is disposed on the other one of the top air-outlet assembly and the top cover assembly; when the top air-outlet assembly is ascended or descended with respect to the top cover assembly, the adjustment mechanism and the detection mechanism can be close to or away from each other; the adjustment mechanism has expanding-retracting elasticity; in the process of the ascending and descending motion of the top air-outlet assembly with respect to the top cover assembly, when the adjustment mechanism touches the detection mechanism, the detection mechanism sends a detection signal to the controller, to make the controller control the top air-outlet assembly to continue moving within an elastic expanding-retracting range of the adjustment mechanism.

[0008] In an embodiment, the adjustment mechanism includes a guide pillar and an elastic connector; the top air-outlet assembly is provided with a mounting portion, the guide pillar is slidingly disposed on the mounting portion; the elastic connector is disposed between the guide pillar and the mounting portion.

[0009] In an embodiment, the mounting portion includes a fixing block; the fixing block is provided with a through hole for passing through by the guide pillar; the guide pillar has a first end and a second end, and the guide pillar is restricted by the first end and the second end from releasing from the through hole.

[0010] In an embodiment, the elastic connector is a spring, and the spring is sleeved on the guide pillar between the first end and the fixing block.

[0011] In an embodiment, the adjustment mechanism further includes a screw configured to form the second end; the guide pillar is provided with a screw hole cooperating with the screw.

[0012] In an embodiment, the detection mechanism includes a stroke switch, the stroke switch is fixed on the top cover assembly, when the stroke switch touches the first end of the guide pillar, the stroke switch sends a detection signal to the controller, to make the controller control the top air-outlet assembly to continue moving a preset distance.

[0013] In an embodiment, the top air-outlet assembly includes a support frame; the adjustment mechanism is

disposed on the support frame; the top cover assembly includes a fixing bracket, and the detection mechanism is disposed on the fixing bracket.

[0014] An air conditioner is provided, which includes the top air-outlet device according to any one of the above embodiments.

[0015] A motion control method for a top air-outlet device is provided, wherein the top air-outlet device is the top air-outlet device according to any one of the above embodiments; and the control method includes:

controlling, by a controller, an ascending and descending motion of a top air-outlet assembly with respect to a top cover assembly;

when an adjustment mechanism touches a detection mechanism, controlling, by the controller, the top air-outlet assembly to continue moving within an elastic expanding-retracting range of the adjustment mechanism.

[0016] In an embodiment, when the adjustment mechanism touches the detection mechanism, the controller controls the top air-outlet assembly to continue moving for a preset period of time within the elastic expanding-retracting range of the adjustment mechanism.

[0017] The above-mentioned top air-outlet device adjusts the stroke of the motion of the top air-outlet assembly with respect to the top cover assembly through the adjustment mechanism, and can determine the initial position of the stroke adjusted by the adjustment mechanism through the detection mechanism, so as to control the top air-outlet assembly to continue moving within a distance range with respect to the top cover assembly through the controller. In the conventional top air-outlet device, the top air-outlet assembly cannot continue to move after moving through a fixed stroke, at this moment, the top air-outlet assembly and the top cover assembly may not be completely closed due to product deformation or the like. However, the top air-outlet device of the present disclosure increases a motion stroke of the top air-outlet assembly within the expanding-retracting range of the adjustment mechanism through the adjustment mechanism, such that the top air-outlet assembly can be completely closed with the top cover assembly to ensure the sealing of the air outlet.

[0018] Since the top air-outlet device has the above-mentioned advantages, the air conditioner including the top air-outlet device also has the corresponding advantages.

[0019] The motion control method for the top air-outlet device can implement the automatic control of the motion of the top air-outlet assembly with respect to the top cover assembly, such that the top air-outlet assembly can be completely closed with the top cover assembly to ensure the sealing of the air outlet.

BRIEF DESCRIPTION OF DRAWINGS

[0020]

FIG. 1 is a structural schematic diagram of a top air-outlet device provided by an embodiment of the present invention;

FIG. 2 is a schematic diagram I of a motion state of a top air-outlet device provided by an embodiment of the present invention;

FIG. 3 is schematic diagram II of a motion state of a top air-outlet device provided by an embodiment of the present invention;

FIG. 4 is a partial enlarged diagram of FIG. 3;

FIG. 5 is schematic diagram III of a motion state of a top air-outlet device provided by an embodiment of the present invention;

FIG. 6 is a schematic assembly diagram I of a top air-outlet device provided by an embodiment of the present invention;

FIG. 7 is a schematic assembly diagram II of a top air-outlet device provided by an embodiment of the present invention;

Fig. 8 is a schematic assembly diagram III of a top air-outlet device provided by an embodiment of the present invention;

FIG. 9 is a schematic exploded assembly diagram of a top air-outlet device provided by an embodiment of the invention.

[0021] Wherein:

a top cover assembly 100;

a fixing bracket 110;
a sealing cover 120;

a top air-outlet assembly 200;

a mounting portion 210; a fixing block 211;
a support frame 220;
an air-outlet panel 230;

a detection mechanism 300;
a stroke switch 310;
an adjustment mechanism 400;
a guide pillar 410; a first end 411; a second end 412;
a plastic connector 420; a screw 430.

DETAILED DESCRIPTION OF DISCLOSED EMBODIMENTS

[0022] In order to make the objectives, the technical schemes and the benefits of the present disclosure more apparent, a top air-outlet device, an air conditioner and a motion control method for the top air-outlet device provided by the present disclosure will be described in more details through the following embodiments with reference

to the accompanying drawings. It should be appreciated that the specific embodiments described herein are merely illustrative of the disclosure and are not intended to limit the disclosure.

[0023] It should be noted that when an element is referred to as being "fixed" to another element, it may be directly on the other element or there may exist an intermediate element. When an element is considered to be "connected" to another element, it may be directly connected to the other element or there may also exist an intermediate element. In contrast, when an element is referred to as being "directly on" another element, there is no intermediate element. The terms "vertical," "horizontal," "left," "right," and the like as used herein are only for a purpose of illustration.

[0024] The top air-outlet device provided by the disclosure can be applied to an air conditioner of a top air-outlet type. In order to increase an air supply range of the air conditioner and improve the cooling comfort, an air-outlet panel is usually disposed to have an ascending and descending structure with respect to an air conditioner top cover, and the air-outlet panel is provided with an air outlet. In the process of working of the air conditioner, the air-outlet panel is ascended by a certain distance with respect to the top cover, so that the air conditioner can supply airflow to a farther place through the air outlet. When the air conditioner does not work, the air-outlet panel is descended with respect to the top cover and can be accommodated inside the air conditioner after being in place. The disclosure is intended to solve the problem that when the air conditioner does not work, in the process that the air-outlet panel is descended and closed with the air conditioner top cover, the motion stroke of the air-outlet panel of the conventional air conditioner is fixed; and when the air-outlet panel is descended to a preset position and closed with the top cover, due to deformation of the air-outlet panel or the structure of the air conditioner top cover, a gap or uneven closure may occur after closing, which not only affects the appearance of the air conditioner, but also causes the external dust to enter the air conditioner and affect the normal operation of the air conditioner.

[0025] As shown in FIG. 1, a top air-outlet device according to an embodiment of the present invention includes a top cover assembly 100, a top air-outlet assembly 200, a detection mechanism 300, an adjustment mechanism 400 and a controller. The top cover assembly 100 is configured to mount on a top portion of the air conditioner. The top air-outlet assembly 200 can be descended with respect to the top cover assembly 100 such that an air outlet of the top air-outlet assembly 200 can be opened by the top cover assembly 100 or closed by the top cover assembly 100. In fact, the open and closed state of the air outlet is also the open or closed state of the top air-outlet assembly 200 with respect to the top cover assembly 100. The ascending and descending motion of the top air-outlet assembly 200 with respect to the top cover assembly 100 is controlled by a controller. Under normal conditions, the controller controls the top air-outlet assembly 200 to ascend with respect to the top cover assembly 100 until the top air-outlet assembly 200 reaches a preset position (working position), the air outlet is opened and the air conditioner is in the operation of an air-out state. When there is no need to perform the air conditioning for the environment, the controller controls the top air-outlet assembly 200 to descend with respect to the top cover assembly 100 until the top air-outlet assembly 200 reaches a preset position (a closed position), the air outlet is closed. At this time, in theory, the top air-outlet assembly 200 should be tightly closed with the top cover assembly 100, and a distance between the working position and the closed position is the stroke required for the motion of the top air-outlet assembly 200.

[0026] The adjustment mechanism 400 is configured to increase the above-mentioned stroke within an expanding-retracting range thereof, such that the top air-outlet assembly 200 can continue to descend for a distance after reaching the closed position, to reduce a clearance distance between the top air-outlet assembly 200 and the top cover assembly 100, so as to solve the technical problem that there is a gap between the top air-outlet assembly 200 and the top cover assembly 100 when the top air-outlet assembly 200 reaches the closed position. Furthermore, the detection mechanism 300 is configured to detect when the top air-outlet assembly 200 reaches the closed position and send a signal to the controller when detecting that the top air-outlet assembly 200 reaches the closed position, to enable the controller to control the top air-outlet assembly 200 to continue to descend for a distance and then stop, in which the distance is determined by the expanding-retracting range of the adjustment mechanism 400. In fact, during the actual operation, it is only necessary to set a program for the controller to make the controller control the top air-outlet assembly 200 to continue moving for a while and then stop.

[0027] The adjustment mechanism 400 may be disposed on the top air-outlet assembly 200 or the top cover assembly 100, and the detection mechanism 300 is oppositely disposed on the top cover assembly 100 or the top air-outlet assembly 200, and the two can cooperate with each other as long as they can get into a touching state in the process of the ascending and descending motion of the top air-outlet assembly 200 with respect to the top cover assembly 100.

[0028] As a preferred embodiment, the adjustment mechanism 400 includes a guide pillar 410 and an elastic connector 420. The top air-outlet assembly 200 is provided with a mounting portion 210, the guide pillar 410 is slidingly disposed on the mounting portion 210; and the elastic connector 420 is disposed between the guide pillar 410 and the mounting portion 210.

[0029] The elastic connector 420 may be a spring or a spring piece or the like. The guide pillar 410 is mounted on the top air-outlet assembly 200 through the mounting portion 210, and is configured to touch the detection mechanism 300. Preferably, the detection mechanism

300 includes a stroke switch 310 which is fixed on the top cover assembly 100. In the process that the top air-outlet assembly 200 is descended and closed with the top cover assembly 100, when the guide pillar 410 touches the stroke switch 310, the stroke switch 310 sends a signal to the controller to make the top air-outlet assembly 200 continue to descend, and the mounting portion 210 is also descended therewith. Because the guide pillar 410 can slide with respect to the mounting portion 210, the stroke switch 310 and the guide pillar 410 abut against each other, which does not affect the continuously descending of the top air-outlet assembly 200, and the guide post 410 is jacked upwards for a distance by the stroke switch 310, such that the elastic connector 420 disposed between the guide pillar 410 and the mounting portion 210 is compressed. The elastic connector 420 is compressed and deformed, and the maximum elastic deformation amount of the elastic connector 420 and the length of the guide pillar 410 together determine the above-mentioned expanding-retracting range of the adjustment mechanism 400.

[0030] Specifically, the mounting portion 210 includes a fixing block 211. The fixing block 211 is provided with a through hole for passing through by the guide pillar 410. The guide pillar 410 has a first end 411 and a second end 412, and the guide pillar 410 is restricted by the first end 411 and the second end 412 from releasing from the through hole. Preferably, the elastic connector 420 is a spring which is sleeved on the guide pillar 410 between the first end 411 and the fixing block 211, wherein the spring may be a helical spring, a compression spring, or the like.

[0031] Referring to FIGS. 2 to 5, seen from the direction of the diagram, the first end 411 is the lower end of the guide pillar 410, the second end 412 is the upper end of the guide pillar 410. In the process that the top air-outlet assembly 200 is descended and closed with the top cover assembly 100, in the initial stage, under the action of the spring, the lower end of the guide pillar 410 protrudes from the lower end surface of the fixing block by a length LI, supposing that the spring is in an unstressed state at the moment, and the two ends of the spring are respectively abutted against the guide pillar 410 and the fixing block; then the lower end of the guide pillar 410 touches the stroke switch 310, and the spring is instantly compressed, such that the protruding length of the lower end of the guide pillar 410 from the lower end surface of the fixing block is shortened to L2; and meanwhile the controller may control the top air-outlet assembly 200 to continue descending, and the spring is continuously compressed, such that the protruding length of the lower end of the guide pillar 410 from the lower end surface of the fixing block is shortened to L3; supposing that the spring is already at its maximum deformation at this moment, a stroke range which can be adjusted by the adjustment mechanism 400 is 0 to L, where L = L1 - L3.

[0032] Furthermore, the adjustment mechanism 400 further includes a screw 430, and the screw 430 constitutes the above-mentioned second end 412. The guide pillar 410 is provided with a screw hole cooperating with the screw 430, and is fixed in the screw hole through the screw 430, thus the mounting and disassembly of the guide pillar 410 and the fixing block may be convenient, so that it is possible to replace with a guide pillar 410 having a different length or replace with a spring having a different deformation degree according to different requirements of the stroke, so as to achieve the purpose of adjusting different range of the stroke.

[0033] In other embodiments, the mounting portion 210 may be a slot, and one end of the guide pillar 410 is fixed in the slot through the elastic connector 420, and the other end is a free end which can be extended or retracted with respect to the slot.

[0034] In other embodiments, the detection mechanism 300 may include a pressure sensor electrically connected to the controller. The top cover assembly 100 is provided with a bump configured to touch the adjustment mechanism 400, and the pressure sensor is disposed at a position where the bump touches the adjustment mechanism 400. When the bump touches the adjustment mechanism 400, the pressure sensor generates a pressure signal and feeds it back to the controller, and the controller controls the top air-outlet mechanism to continue moving for a preset distance.

[0035] Referring to FIG. 1 and FIG. 9, as a preferred embodiment, the top air-outlet assembly 200 includes a support frame 220, and the adjustment mechanism 400 is disposed on the support frame 220. The top cover assembly 100 includes a fixing bracket 110, and the detection mechanism 300 is disposed on the fixing bracket 110. Furthermore, the top air-outlet assembly 200 further includes an air-outlet panel 230. The top cover assembly 100 further includes a sealing cover 120. The sealing cover 120 is annular, and the air-outlet panel 230 has a cylindrical shape. The sealing cover 120 is configured to sleeve outside the air-outlet panel. When the air outlet of the top air-outlet assembly 200 is closed by the top cover assembly 100, the edge of the upper end surface of the air-outlet panel 230 can be tightly closed with the upper edge of the sealing cover 120.

[0036] The upper end surface of the air-outlet panel 230 has an arc shape, and the distance from the edge of the upper end surface of the air-outlet panel 230 to the top cover assembly 100 is varying from small to large. Referring to FIG. 9, the side wall of the air-outlet panel 230 is low on one side and high on the other side, and the upper end surface has a convexly arc shape to cover the upper edge of the side wall, and the outer shape of the sealing cover 120 is adapted to the outer shape of the air-outlet panel 230.

[0037] Referring to FIG. 6, furthermore, the upper edge of the sealing cover 120 has a shape of a bell mouth, and the upper end side wall of the air-outlet panel 230 can be adapted to the upper edge of the sealing cover 120, thereby increasing the contact area when they are closed, such that the closing is more tightly.

[0038] Referring to FIG. 6 to FIG. 8, specifically, the air-outlet panel 230 is fixed on the support frame 220, the sealing cover 120 is fixed on the top cover assembly 100, and the support frame 220 can be ascended and descended with respective to the fixing frame 110, such that the air-outlet panel 230 can move up and down with respect to the sealing cover 120, so as to make the air-outlet panel 230 have an open and closed state with respect to the sealing cover 120. When the air-outlet panel 230 is ascended to the working position, as shown in FIG. 6, the air conditioner blows out airflow through the air outlet on the air-outlet panel 230; and when the air-outlet panel 230 is lowered to the closed position, as shown in FIG. 7, there is a gap between the air-outlet panel 230 and the sealing cover 120 at this moment. Under the cooperation of the adjustment mechanism 400 and the detection mechanism 300, the air-outlet panel 230 can continue to descend a distance, as shown in FIG. 8, at this moment the air-outlet panel 230 is tightly closed with the sealing cover 120 seamlessly.

[0039] As a preferred embodiment, the top air-outlet device further includes a power source and a transmission mechanism. The power source is electrically connected to the controller; the power source is disposed on the top cover assembly 100, and the power source drives the top air-outlet assembly 200 to move with respect to the top cover assembly 100 through the transmission mechanism.

[0040] The power source may be a motor or the like, and the controller controls the move or stop of the top air-outlet assembly 200 with respect to the top cover assembly 100 through controlling the operation or stop of the motor.

[0041] Specifically, the transmission mechanism includes a gear and a rack. The gear is disposed on an output shaft of the motor, and the rack is disposed on the top air-outlet assembly 200. The motor drives the gear to do reciprocating motion to drive the rack to do reciprocating motion, such that the top air-outlet assembly 200 can do ascending and descending motion with respect to the top cover assembly 100.

[0042] The embodiment of the invention further provides an air conditioner including the air-outlet device as described above, so that the air-outlet panel and the top cover of the air conditioner can be closed tightly, not only having good appearance, but also preventing the dust and the like from entering the air conditioner.

[0043] Another embodiment of the present invention further provides a motion control method for a top air-outlet device, wherein a top air-outlet device is the above-described top air-outlet device; and the control method includes: controlling, by a controller, an ascending and descending motion of a top air-outlet assembly with respect to a top cover assembly; when an adjustment mechanism touch a detection mechanism, controlling, by the controller, the top air-outlet component to continue moving within an elastic expanding-retracting range of the adjustment mechanism; thereby implementing the automatic control of motion of the top air-outlet assembly with respect to the top cover assembly, such that the top air-outlet assembly can be completely closed with the top cover assembly to ensure the sealing of the air outlet. Specifically, during the actual operation, it is possible to set a program to the controller, and when the adjustment mechanism touches the detection mechanism, the controller controls the top air-outlet assembly to continue moving for a preset period of time within the elastic expanding-retracting range of the adjustment mechanism, in which the preset period of time is approximately 1 to 2 seconds.

[0044] The technical features of the above-described embodiments may be arbitrarily combined. For the sake of brevity of description, not all possible combinations of the technical features in the above embodiments are described. However, as long as there is no contradiction in the combination of these technical features, all should be considered as in the scope of the disclosure.

[0045] The above-described embodiments are merely illustrative of several embodiments of the present invention, and the description thereof is more specific and detailed, but is not to be construed as limiting the scope of the invention. It should be noted that a number of variations and improvements may be made by those skilled in the art without departing from the concept of the invention. Therefore, the scope of the disclosure should be determined by the appended claims.

Claims

1. A top air-outlet device, comprising a top cover assembly (100), a top air-outlet assembly (200), a detection mechanism (300), an adjustment mechanism (400) and a controller;
   wherein the top air-outlet assembly (200) is capable of ascending and descending with respect to the top cover assembly (100), such that an air outlet of the top air-outlet assembly (200) can be opened or closed by the top cover assembly (100); the controller is configured to control an ascending and descending motion of the top air-outlet assembly (200) with respect to the top cover assembly (100);
   the adjustment mechanism (400) is disposed on one of the top air-outlet assembly (200) and the top cover assembly (100), the detection mechanism (300) is disposed on the other one of the top air-outlet assembly (200) and the top cover assembly (100); when the top air-outlet assembly (200) is ascended or descended with respect to the top cover assembly (100), the adjustment mechanism (400) and the detection mechanism (300) can be close to or away from each other; the adjustment mechanism (400) has an expanding-retracting elasticity; in the process of the ascending and descending motion of the top air-outlet assembly (200) with respect to the top cover assembly (100), when the adjustment mechanism

(400) touches the detection mechanism (300), the detection mechanism (300) sends a detection signal to the controller to make the controller control the top air-outlet assembly (200) to continue moving within an elastic expanding-retracting range of the adjustment mechanism (400).

2. The top air-outlet device according to claim 1, wherein the adjustment mechanism (400) comprises a guide pillar (410) and an elastic connector (420); the top air-outlet assembly (200) is provided with a mounting portion (210), the guide pillar (410) is slidingly disposed on the mounting portion (210); the elastic connector (420) is disposed between the guide pillar (410) and the mounting portion (210) .

3. The top air-outlet device according to claim 2, wherein the mounting portion (210) comprises a fixing block (211); the fixing block (211) is provided with a through hole for passing through by the guide pillar (410);
the guide pillar (410) has a first end (411) and a second end (412), and the guide pillar (410) is restricted by the first end (411) and the second end (412) from releasing from the through hole.

4. The top air-outlet device according to claim 3, wherein the elastic connector (420) is a spring, and the spring is sleeved on the guide pillar (410) between the first end (411) and the fixing block (211).

5. The top air-outlet device of claim 3, wherein the adjustment mechanism (400) further comprises a screw (430) configured to form the second end (412); the guide pillar (410) is provided with a screw hole cooperating with the screw (430).

6. The top air-outlet device according to claim 3, wherein the detection mechanism (300) comprises a stroke switch (310), the stroke switch (310) is fixed on the top cover assembly (100), when the stroke switch (310) touches the first end (411) of the guide pillar, the stroke switch (310) sends a detection signal to the controller to make the controller control the top air-outlet assembly (200) to continue moving a preset distance.

7. The top air-outlet device according to any one of claims 1 to 6, wherein the top air-outlet assembly (200) comprises a support frame (220); the adjustment mechanism (400) is disposed on the support frame (220); the top cover assembly (100) comprises a fixing bracket (110), and the detection mechanism (300) is disposed on the fixing bracket (110).

8. An air conditioner, comprising the top air-outlet device according to any one of claims 1 to 7.

9. A motion control method for a top air-outlet device of any one of claims 1 to 7, comprising:

controlling, by a controller, an ascending and descending motion of a top air-outlet assembly with respect to a top cover assembly;
when an adjustment mechanism touches a detection mechanism, controlling, by the controller, the top air-outlet assembly to continue moving within an elastic expanding-retracting range of the adjustment mechanism.

10. The motion control method for a top air-outlet device according to claim 9, wherein when the adjustment mechanism touches the detection mechanism, the controller controls the top air-outlet assembly to continue moving for a preset period of time within the elastic expanding-retracting range of the adjustment mechanism.

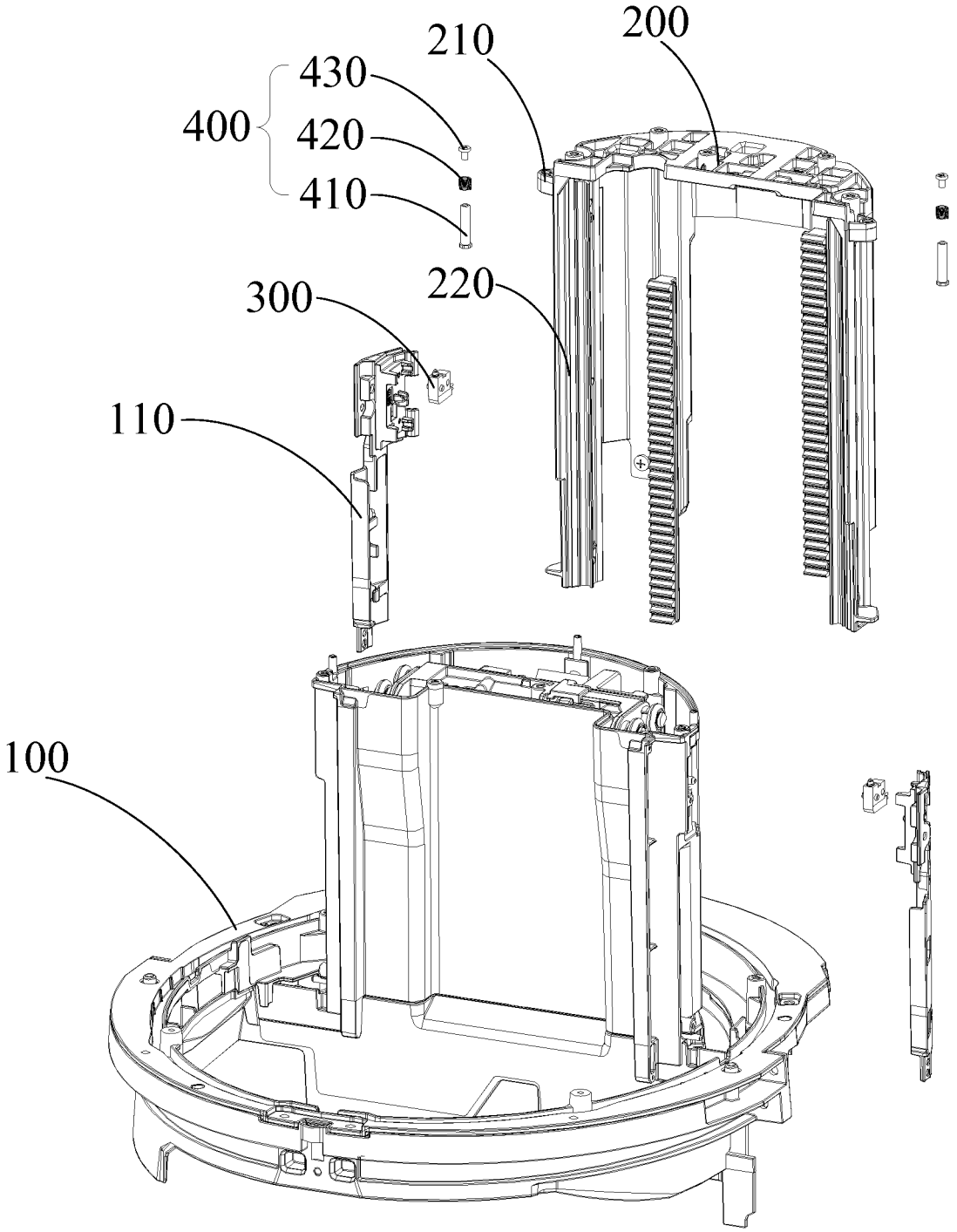

FIG. 1

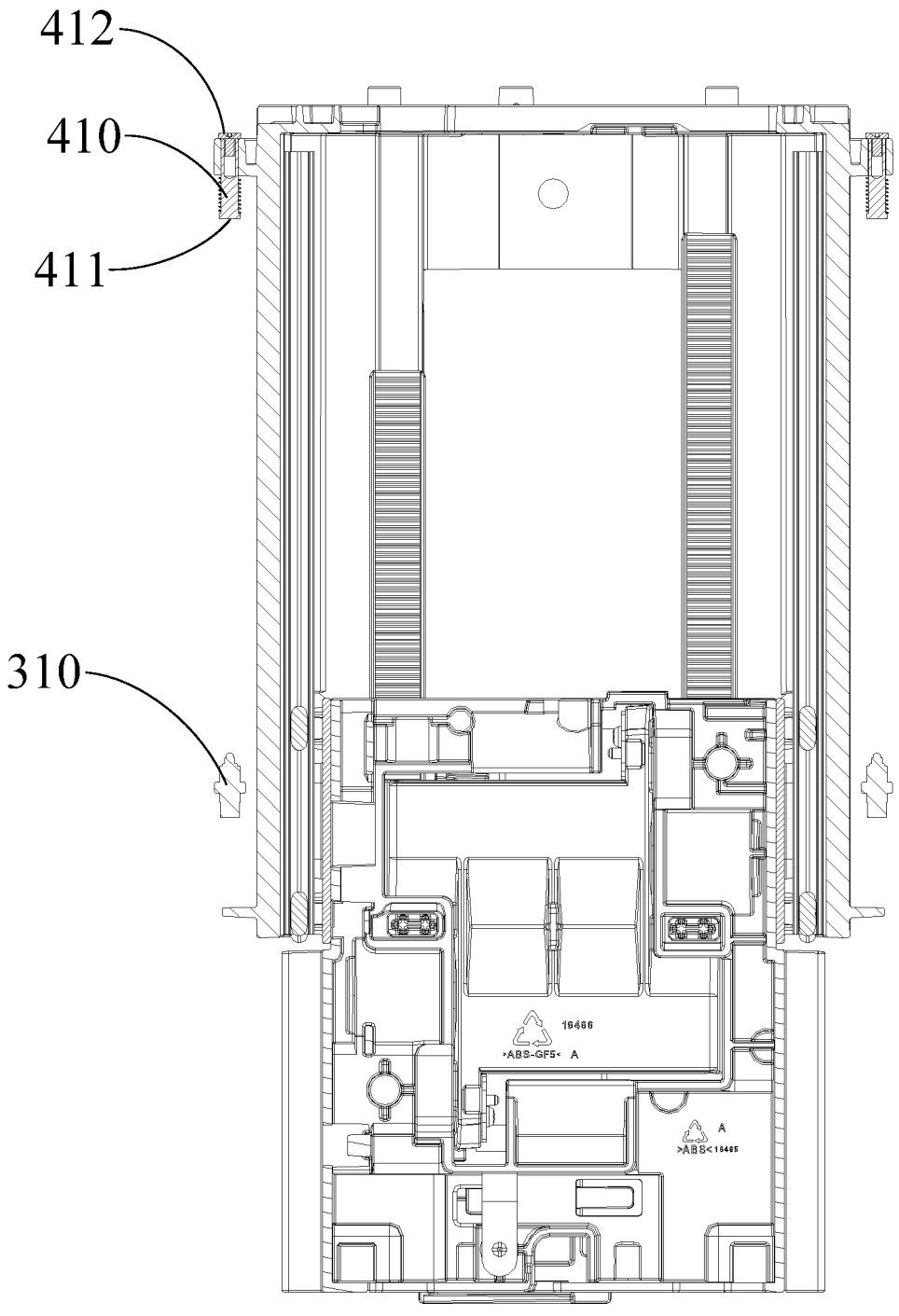

FIG. 2

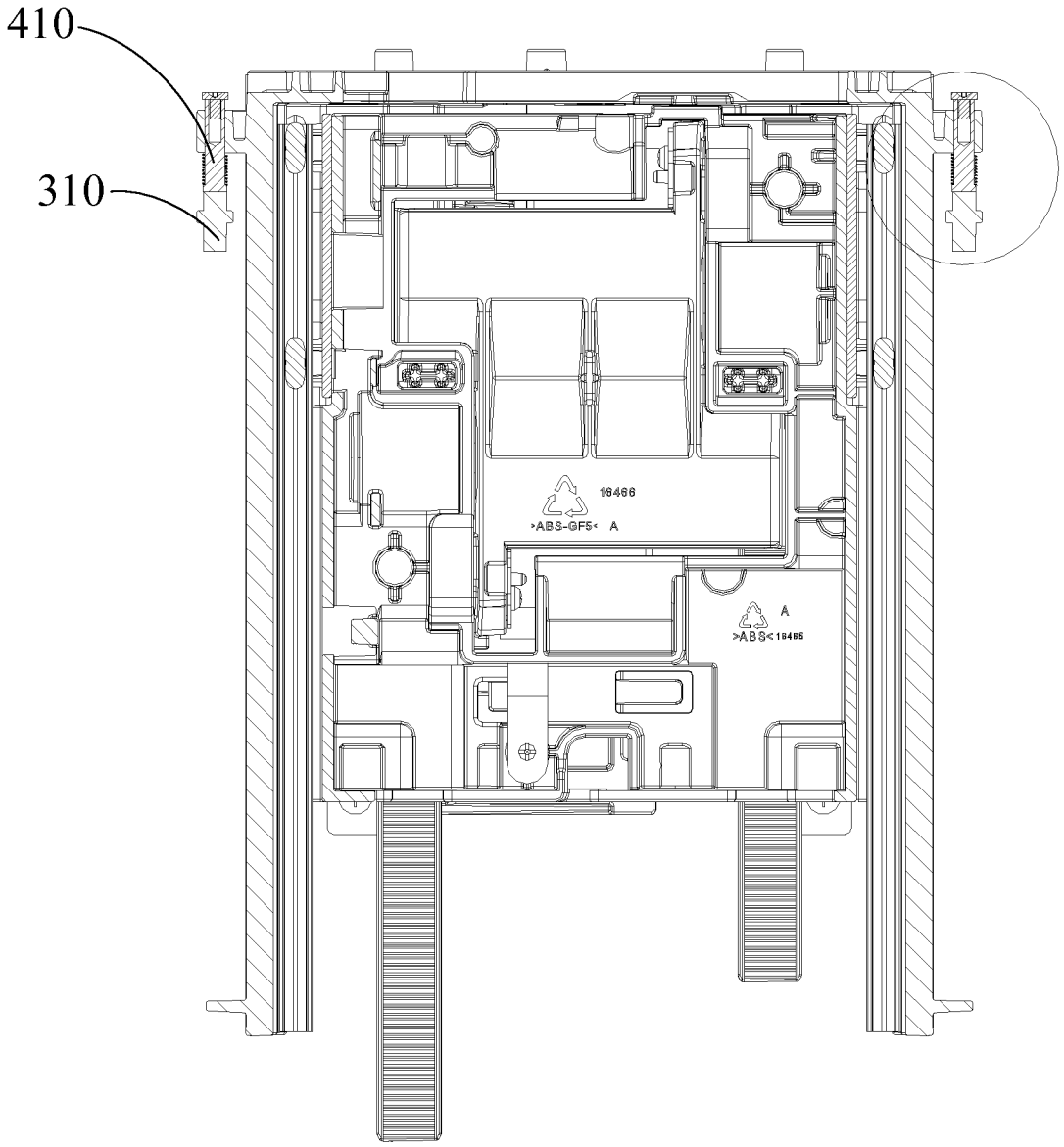

FIG. 3

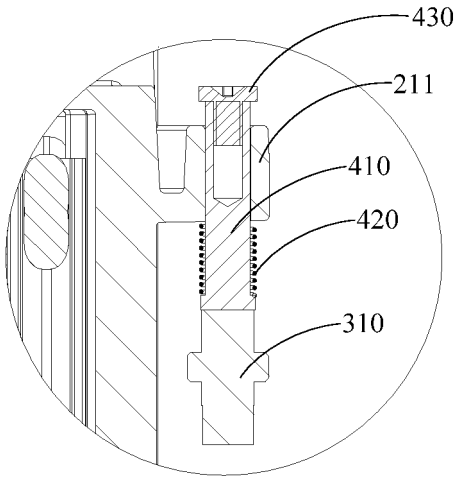

FIG. 4

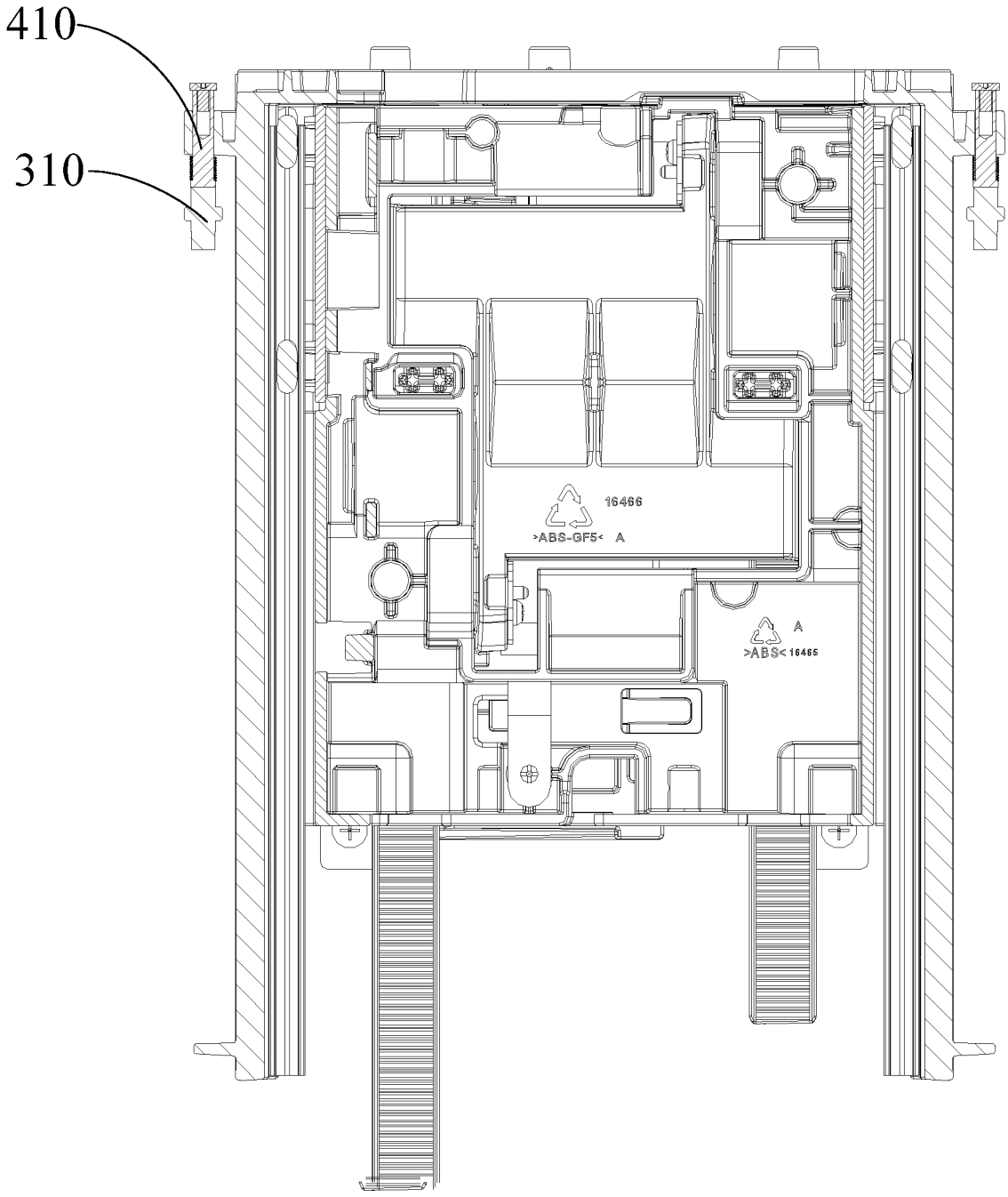

FIG. 5

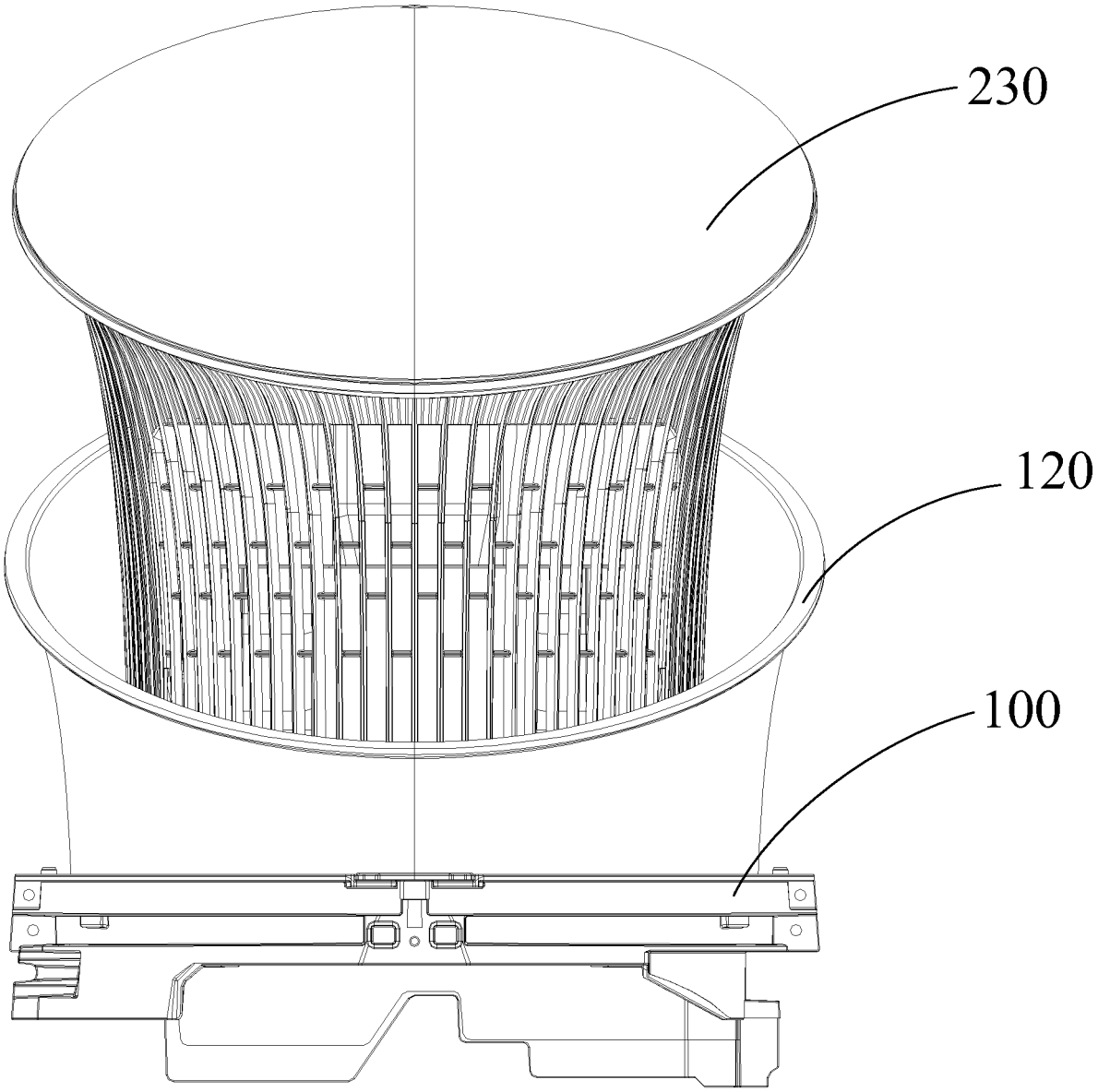

FIG. 6

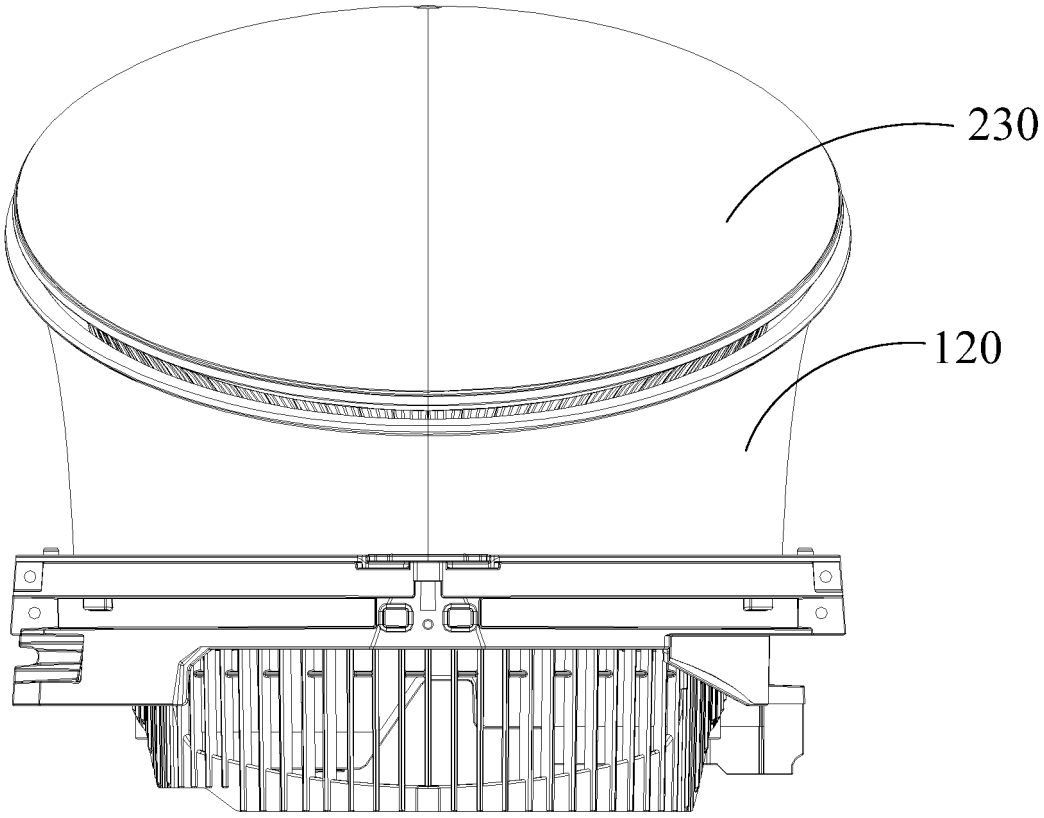

FIG. 7

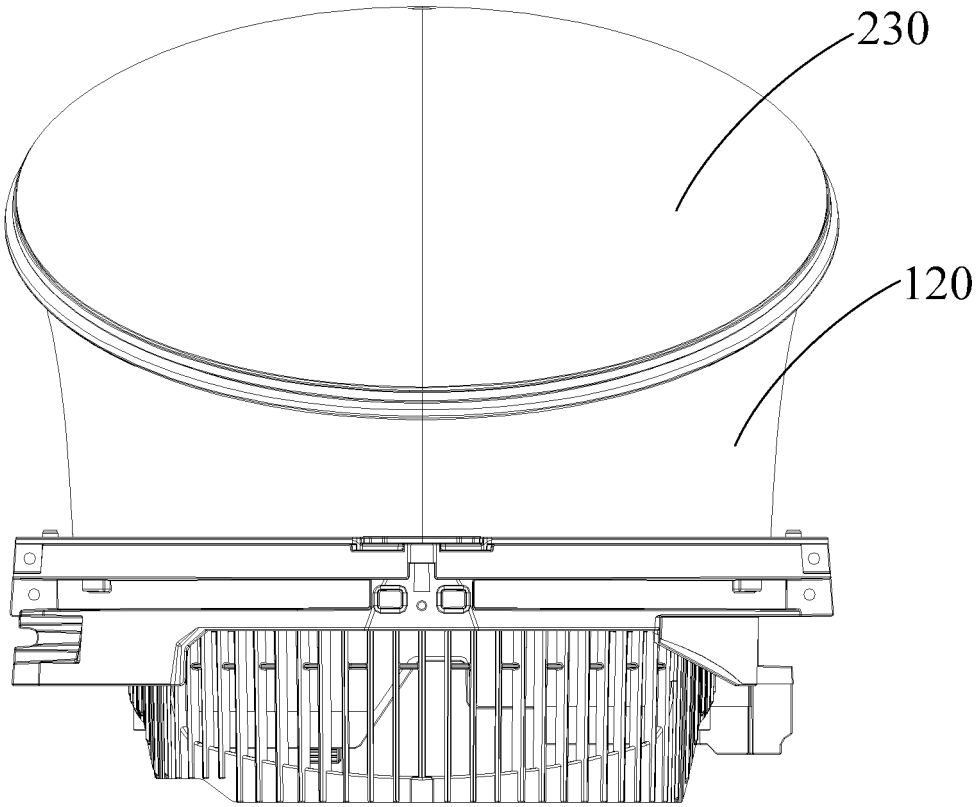

FIG. 8

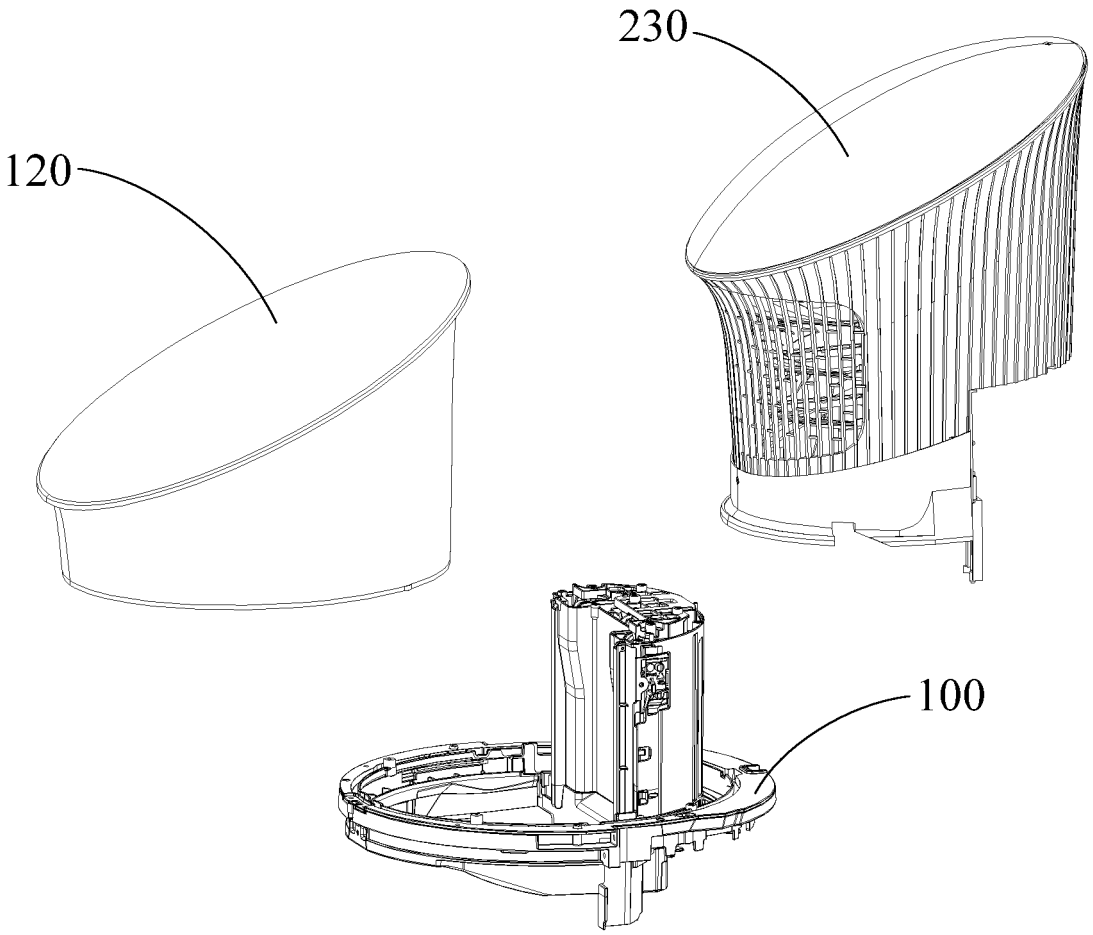

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/106877

A. CLASSIFICATION OF SUBJECT MATTER

F24F 13/10 (2006.01) i; F24F 13/20 (2006.01) i; F24F 11/00 (2018.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI, SIPOABS, CNKI, CNABS, 珠海格力电器股份有限公司, 李德清, 丘晓宏, 蒲敏, 调节, 控制, 闭合, 空调, 顶盖, 检测, 伸缩, 弹性, discharg+, air conditioner, detect+, controller, ejection

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 106642618 A (GREE ELECTRIC APPLIANCES INC. ZHUHAI) 10 May 2017 (10.05.2017), description, pages 1-6, and figures 1-9	1-10
PX	CN 206449815 U (GREE ELECTRIC APPLIANCES INC. ZHUHAI) 29 August 2017 (29.08.2017), description, pages 1-5, and figures 1-9	1-10
A	CN 106225080 A (WUHU MEIZHI AIR-CONDITIONING EQUIPMENT CO., LTD. et al.) 14 December 2016 (14.12.2016), description, pages 1-8, and figures 1-5	1-10
A	US 2016327297 A1 (SAMSUNG ELECTRONICS CO., LTD.) 10 November 2016 (10.11.2016), description, paragraphs [0001]-[0226], and figures 1-8	1-10
A	KR 20090116522 A (SAMSUNG ELECTRONICS CO. LTD.) 11 November 2009 (11.11.2009), description, paragraphs [0001]-[0079], and figures 1-4	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 January 2018	11 January 2018

Name and mailing address of the ISA	Authorized officer
State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	WANG, Wei Telephone No. (86-10) 62414406

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/106877

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 106642618 A	10 May 2017	None	
CN 206449815 U	29 August 2017	None	
CN 106225080 A	14 December 2016	None	
US 2016327297 A1	10 November 2016	CN 106123112 A	16 November 2016
		US 9557070 B2	31 January 2017
		WO 2016178521 A1	10 November 2016
		EP 3091296 B1	13 September 2017
		CN 106907771 A	30 June 2017
		US 2017108229 A1	20 April 2017
		EP 3091296 A1	09 November 2016
		US 2017102154 A1	13 April 2017
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		KR 20160132321 A	17 November 2016
		KR 20160131841 A	16 November 2016
		KR 1707618 B1	21 February 2017
		AU S2017108229 A1	26 October 2017
KR 20090116522 A	11 November 2009	None	

Form PCT/ISA /210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201710018070 **[0001]**